St. Mary's Medical Center
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James F. Zucherman, MD
Medical Director

Spine Center
One Shrader Street, Suite 450
San Francisco, CA 94117-1079
(415) 750-5835 *direct*
(415) 750-8103 *fax*
www.spine-dr.com
yaquai@aol.com

Complications of Total Disc Arthroplasty

Disarticulation

Implant-specific issues.

Pro-Disc. The poly component is seated in the lower endplate and held in position by a small bump. Attention by the surgeon is necessary to make sure that the poly insert is fully seated in the device and flush with the anterior border of the lower endplate. This requires direct visualization and palpation after placement of the device.

Inadequate posterior release with prevent proper seating of the poly as the posterior aspect of the interspace will not open up fully, allowing the poly to be seated. Too anterior position of the device may increase shear stresses on the poly and possibly cause anterior migration as well as limited motion. Care must be taken to scrutinize the position of the patient on the table. Lumbar hyperextension closes the posterior aspect of the interspace and makes it difficult to obtain adequate posterior release, and may encourage the surgeon to take off more posterior endplate than he desires.

With the FlexiCore device, the smallest size currently available is 13 mm. This may be too large for a few of the patients.

The Charite has minimal shear resistance built into its design, with the only resistance being the shallow depressions of the polyethylene disc in the upper and lower endplates. The endplates themselves have no ingrowth mechanism in the U.S. model. Shear stresses after implantation will pass through the interspace with minimal resistance from the prosthesis itself and will be taken up mostly by the pedicle and facet joints. If either of these fail, dislocation of the poly may occur.

Generic implant issues

Prevention of dislocation/subluxation.

Proper sagittal alignment allows for the devices to function as they are intended with maximum motion. This also reduces the forces on the implant and on the posterior elements. As mentioned above, adequate posterior vertebral height is mandatory, and unless the disc height is unusually high, typically the entire posterior annulus is loosened or transected, as well as the PLL. Anesthesia muscle relaxation is necessary, especially for more heavily muscled patients. Some lumbosacral flexion facilitates posterior placement of the implant and is desirable. Magnification when removing the disc posteriorly has been very helpful in our hands.

Similarly, coronal alignment is equally important. Non-rotated flouro views must be obtained to accurately mark the midline, and the midline must be attended to throughout the procedure. The implant should be a size large enough to reach the pedicles, ideally bisecting the pedicle on each side. Having implant off-center predisposes to subarticular entrapment, lateral angulation, eccentric settling, and anterior sagittal misplacement. Attention should be made to the soft tissue release so that it is symmetric.

Sizing of the implant is also important. As mentioned, the implant should be the largest that fits within the disc. The implant should be snug enough so that there is no anterior migration in the interspace; however, if placed in too tightly, motion will be diminished.

Wear issues.

There are some recent reports of metal-on-metal delayed hypersensitivity reactions in total joint replacements, and this may be an occasional factor in predisposed patients. Wear issues involving the polyethylene are likely related to position of the device, as a malpositioned polyethylene metal device will be expected to generate more wear particles and also suffer from more plastic deformation or creep.

Subsidence.

Subsidence can certainly destroy the biomechanical effect of the implant, cause pain, and promote autofusion. The surgeon, of course, should be aware of osteoporosis risk factors, and bone density should be performed on overweigh women, smokers, women over 55, and individuals with other risk factors. Vertebral endplate configurations in which there is prominent "fishmouthing" or concavity usually require some resection of the posterior endplate, which can be a factor in weakening the posterior vertebral body and possibly causing settling of the posterior aspect of the prosthesis. One should keep the device co-linear with the endplates as much as possible. Using the largest prosthesis the disc will accept also discourages subsidence. Especially at the L5-S1 level, flexion of the hips is helpful in keeping the lumbosacral angle less hyperextended and enabling adequate release with as little resection of the posterior endplates as possible.

Postoperative leg pain.

Postoperative leg pain is noted to be more common in previously markedly collapsed interspaces, especially those that have had previous laminotomies at the same segment. This is not surprising that some stretch injuries may occur to the nerve in this situation. In that case, there is usually pain immediately after the surgery. This usually fades away, in our experience. In three of 150 motion segments, we have noted delayed-onset radicular symptoms on standing and walking. Two of these had posterior decompressions without apparent stenosis present but with subsequent relief after the procedures. The other patient is currently being scheduled. As mentioned, we were not able to identify nerve entrapment at the time of surgery. Whether this is a dynamic factor relating to motion of the implants or an anomaly of the patient population is not clear at this point.

Strategies for revision

When faced with a failure of the implants, timing is of paramount importance in terms of the relationship to the date of the initial surgery. If it is within two to three weeks, the approach is relatively easy, as the early wound healing frequently does not prohibit going in through the same plane. From three weeks to six months is most difficult, as the tissue is friable and can be densely adherent at the same time. Retroperitoneal fibrosis around the great vessels and ureters represents a formidable technical challenge. Beyond six months it is still difficult, but not as treacherous as the intermediate period.

If there is no neural entrapment and no vascular impingement, posterior fusion in situ is a reasonable safe option, and if the timing is early, revision of the device can also be considered.

When there is neural entrapment, if this can be correctible posteriorly, this is preferable for safety reasons. Depending on the timing of the problem's occurrence, anterior revision is another option if early postop enough and depends on the source of the neural compression.

With vascular impingement revision or removal of the implant must always be considered. If there is coronal malalignment, I personally prefer posterior reduction and subsequent anterior removal and fusion. With coronal malposition, I feel I cannot tell if the segment has lost its intrinsic stability, and therefore presume it is unstable. If there is only sagittal malalignment, then revision or fusion anteriorly done; anterior plate can be considered, or subsequent posterior pedicle fixation if a fusion is desired. Posterior fusion with subsequent anterior fusion is also a viable option.

As discussed by Dr. Bailey, if there is expulsion anteriorward, it is helpful to know as best as possible where the vein is and whether the vein is compressed. Venogram and ultrasound can be helpful in this regard.

Since we do not have good data on long-term follow-up data on these cases and know some instances of expulsion and failure occur, a prophylactic approach would make sense. We use a tight-weave vascular tubular graft or a large enough piece to be folded over so that there are two layers of graft, one opposite the great vessels, one opposite the disc operative site, extending at least halfway up the vertebral bodies, cephalad and caudad. These are anchored into position to the prevertebral fascia. If revision has to occur in the future, dissection can safely be done between the layers of graft material, and the posterior layer can easily and safely be cut to expose the interspace, while the anterior graft layer can be used to shield the vessels and allow retraction.

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